AD-A144 727 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS HAMMONASSET RESERVOIR..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 78 1/1

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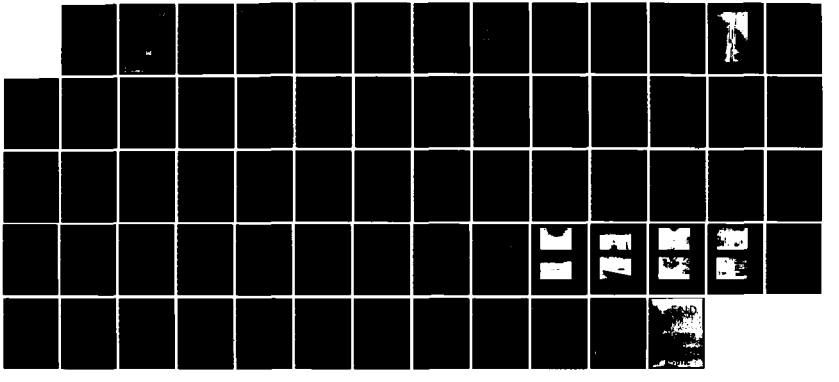

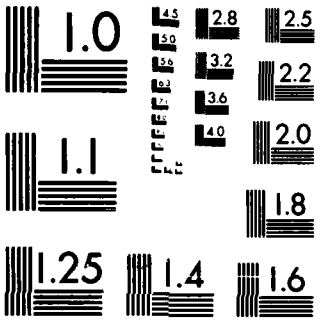

HAMMONASSET RIVER BASIN
MADISON/KILLINGWORTH, CONNECTICUT

HAMMONASSET RESERVOIR DAM
CT. 00400

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

SEPTEMBER 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE September 1978 13. NUMBER OF PAGES 55
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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Hammonasset River Bas
Madison/Killingworth, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Hammonasset Reservoir Dam is a concrete dam that is 447 feet long with a 163 foot spillway. It has an intake structure with a 36 inch blowoff and gates. Based on visual inspection, records available and past operational performance, the dam is judged to be in good condition. The project will pass 75.8 percent of the PMF before overtopping the dam.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF

NEDED

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

NOV [illegible]

Dear Governor Grasso:

I am forwarding to you a copy of the Hammonasset Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, the New Haven Water Company, 90 Sargeant Drive, New Haven, Connecticut, 06511, ATTN: Mr. Jack Reynolds, Superintendent Source of Supply.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

HAMMONASSET RESERVOIR DAM

CT 00400

HAMMONASSET RIVER BASIN
MADISON/KILLINGWORTH, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification Number:	CT 00400
Name:	Hammonasset Reservoir Dam
Town:	Madison/Killingworth
County & State:	New Haven/Middlesex County, Connecticut
Stream:	Hammonasset River
Date of Inspection:	August 1, 1978

BRIEF ASSESSMENT

The Hammonasset Reservoir Dam is a concrete dam that is 447 feet long with a 163 foot spillway. It has an intake structure with a 36 inch blowoff and gates.

Based on the visual inspection, records available and past operational performance, the dam is judged to be in good condition. There are areas of the dam which should be studied in order to monitor its behavior such as, the downstream side which shows signs of seepage at the junction of the rock and the dam as well as some of the expansion and contraction joints.

The project will pass 75.8 percent of the Probable Maximum Flood (PMF) (recommended spillway design flood) before overtopping the dam. However the spillway capacity is not judged seriously inadequate because the water will flow only 1.15 feet over a concrete non-overflow section.

Recommended measures to be undertaken by the owner include monitoring seepage and establishing an inspection program. The owner shall implement the recommendations and remedial measures described in Section 7 within two to three years after receipt of this Phase I Inspection Report.

Joseph F. Merluzzo
Connecticut P.E. #7639
Project Manager

Richard F. Lyon
Connecticut P.E. #8443
Project Engineer

This Phase I Inspection Report on the Hammonasset Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface evaluations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify the need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and varity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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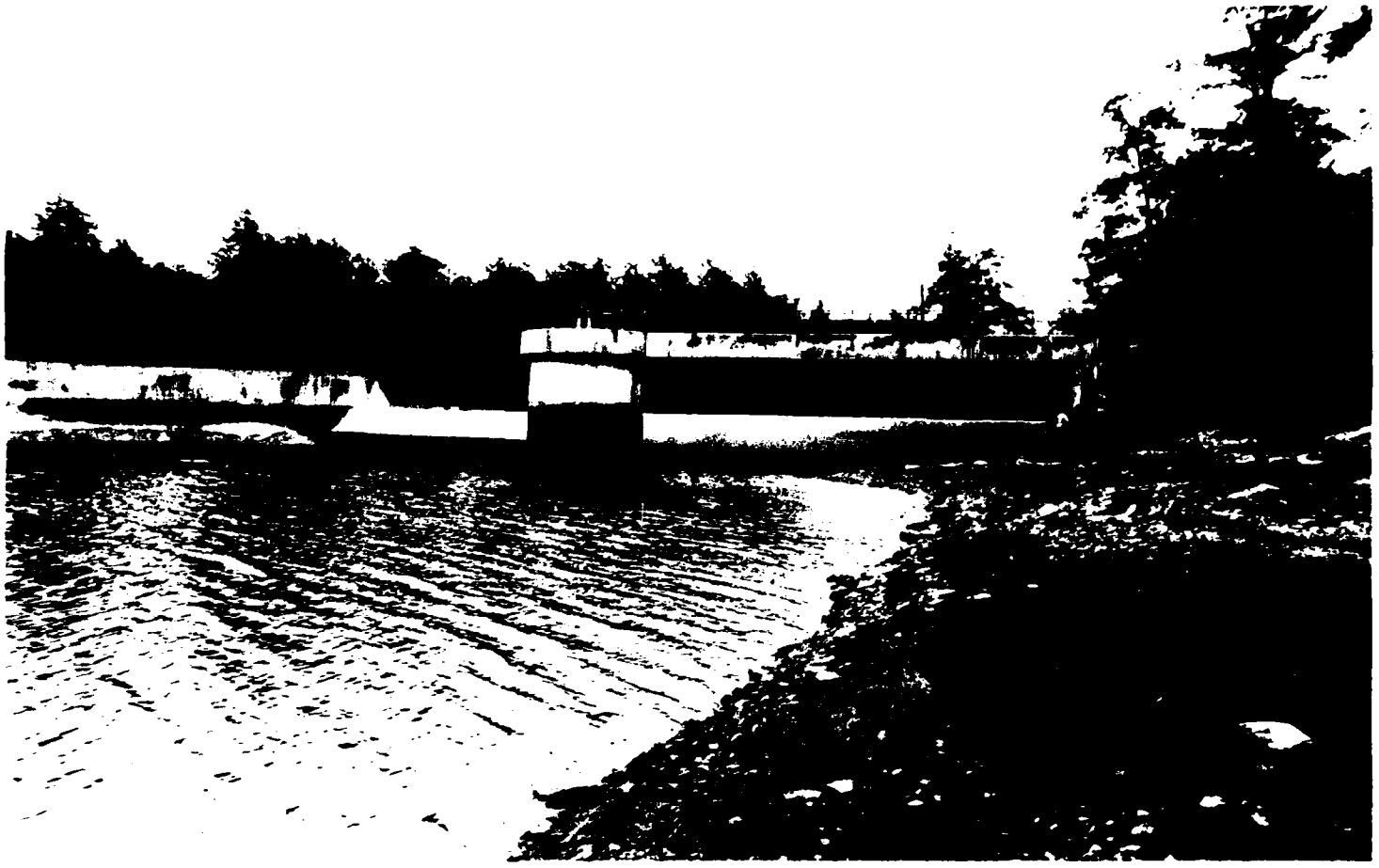
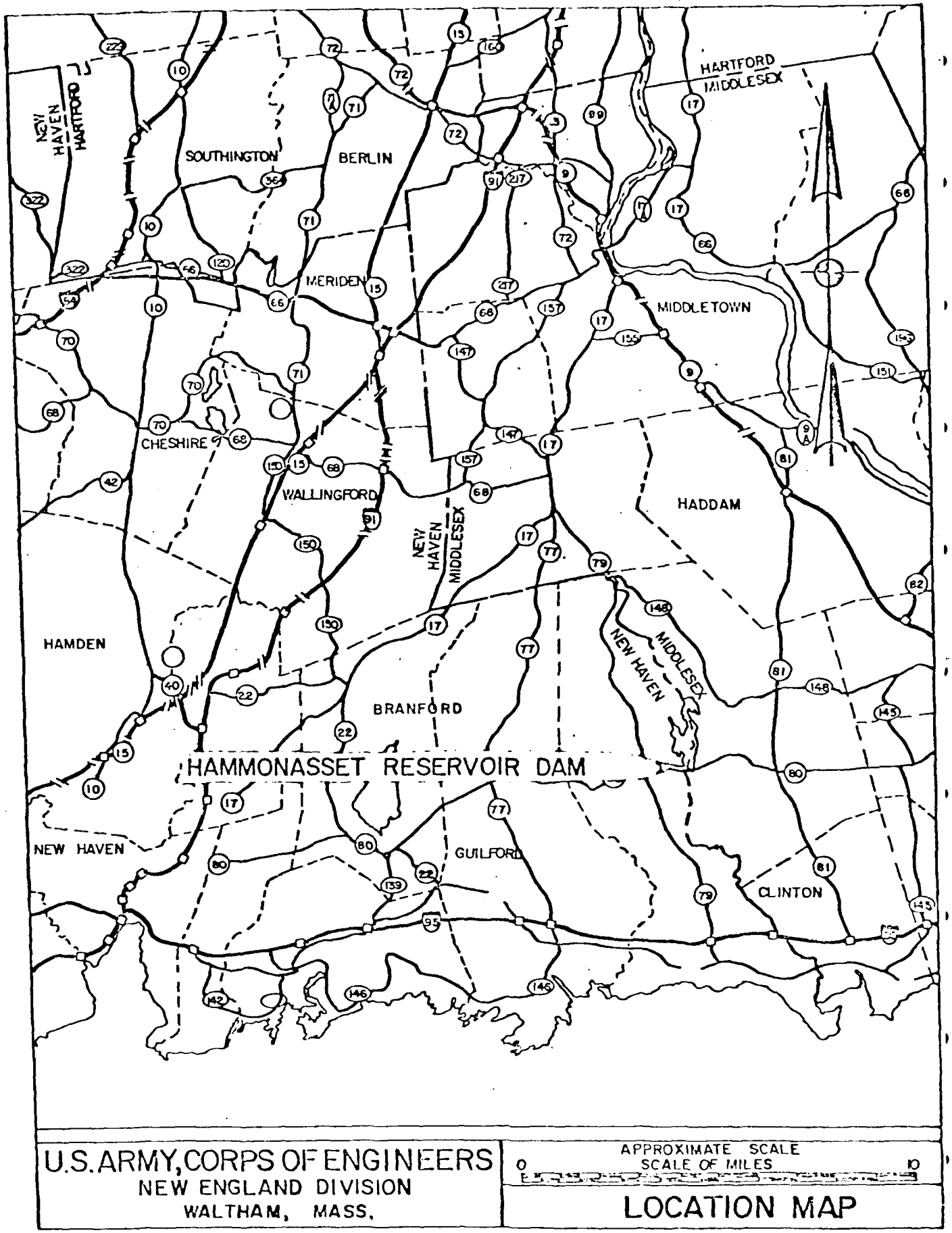


OVERVIEW PHOTO



U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.

APPROXIMATE SCALE
SCALE OF MILES 0 10

LOCATION MAP

PHASE I INSPECTION REPORT

HAMMONASSETT RESERVOIR DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Storch Engineers has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Storch Engineers under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0000 has been assigned by the Corps of Engineers for this work.

b. Purpose -

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly, effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

The Hammonasset Reservoir Dam is owned by the New Haven Water Company of New Haven County, Connecticut. It is located on the borders of the Towns of Madison and Killingworth (See Location Map), and is on the Hammonasset River. The water from this dam is used to supplement the supply of Lake Gaillard which is located approximately 10 miles due west.

This structure is a 163 foot long combination concrete gravity-dam spillway with concrete dike walls located on the east side of the dam. It has an intake well with a 36 inch diameter blowoff line which is used to control the downstream flow.

The size classification of the dam is intermediate (50 feet high and 8,330 acre-feet of storage) and the hazard classification is high per the criteria set forth in the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers. The failure of the dam would result in the inundation of several residential and commercial dwellings downstream. The approximate limits are shown on the Regional Vicinity Map which is located in Appendix D.

The dam was designed in 1955 by Malcolm Pirnie, Consultant Engineer, White Plains, New York. Construction was completed in 1956. The original site where the dam is now located used to have a natural water fall. The dam is designed to be relatively free from maintenance.

The person in charge of day to day operation of the dam is Norman Paluba, New Haven Water Company, New Haven, Connecticut, Telephone Number: 624-6671.

1.3 Pertinent Data

a. Drainage Area - A 19.5 square mile drainage area contributes to the dam. The terrain is rolling with mixed amounts of farm land, orchards and residential development.

b. Discharge at Damsite - The maximum known spillway discharge (from high water marks) was approximately 1,000 cfs. Date of this discharge is not known.

(1) Outlet works: size 36 inch at invert elevation 219.5.

(2) Maximum know flood at damsite: 1,000 cfs.

(3) Ungated spillway capacity at maximum pool elevation: 14,385 cfs at 278 elevation.

(4) Gated spillway capacity at pool elevation: N/A cfs at N/A elevation.

(5) Gated spillway capacity at maximum pool elevation: N/A cfs at N/A elevation.

(6) Total spillway capactiy at maximum pool elevation: 14,385 cfs at 278 elevation.

c. Elevation (Feet above MSL)

(1) Top of of dam: 278.0

(2) Maximum pool-design surcharge: 278

(3) Full flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 270.0

(6) Upstream portal, invert diversion tunnel: 219.5

(7) Streambed at centerline of dam: 217.75

(8) Maximum tailwater: 223.0

d. Reservoir

(1) Length of maximum pool: 10,000 $\pm$ feet

(2) Length of recreation pool: N/A

(3) Length of flood-control pool: N/A

e. Storage (Acre-Feet)

(1) Recreation pool: N/A

(2) Flood-control pool: N/A

(3) Design surcharge: 8,330

(4) Top of dam: 8,330

f. Reservoir Surface (Acres)

(1) Top of dam: 410

(2) Maximum pool: 410

(3) Flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 310

g. Dam

(1) Type: concrete - gravity

(2) Length: 447 feet ±

(3) Height: 50 feet ±

(4) Top width: 2 feet ±

(5) Side Slopes: N/A

(6) Zoning: N/A

(7) Impervious Core: N/A

(8) Cutoff: 10 feet ±

(9) Grout curtain: none

(10) Other: N/A

h. Diversion and Regulating Tunnel

(1) Type: cast iron

(2) Length: 85 feet ±

(3) Closure: N/A

(4) Access: None

(5) Regulating Facilities: manually operated gate valves - (36" blowoff)

i. Spillway

(1) Type: concrete fixed weir

(2) Length of weir: 163 feet

(3) Crest elevation: 270

(4) Gates: None

(5) U/S Channel: underwater

(6) D/S Channel: natural channel

(7) General: N/A

j. Regulating Outlets

Regulating outlets consist of a single, 36 inch blowoff for the purpose of a compensating water supply for riparian owners.

(1) Invert: 219.5

(2) Size: 36 inch

(3) Description: cast iron

(4) Control Mechanism: manually operated gate valve

(5) Other: N/A

SECTION 2 - ENGINEERING DATA

2.1 Design

The design information is in the form of as-built contract drawings prepared by Malcolm Pirnie Engineers dated March, 1957. Other design information was not available because of the recent move of the headquarters of the New Haven Water Company. A telephone call to Malcolm Pirnie Engineers, Consultant Engineer for this project, determined that designs are available for the capacity-discharge curves, hydrology, structural design of the intake chamber and several stability checks for sliding.

2.2 Construction

The dam was constructed in 1956. Besides the contract plans, there was no other information available, such as photographs, about the construction period.

2.3 Operation

The operation of the blowoff for the dam is manual. There is no data or operating procedure that has been established for its operation.

2.4 Evaluation

a. Availability - The construction drawings were readily available, however, the design by Malcolm Pirni, Inc. could not be located. The dam has no operating procedures.

b. Adequacy - The information that was made available was only a minor factor in the assessment, which was based mainly on the visual inspection, past performance history and hydrologic and hydraulic assumptions.

c. Validity - The construction drawings are accurate to the extent that the visible inspection did not reveal any new features.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The visual inspection was conducted on August 1, 1978 by members of the engineering staff of Storch Engineers, with the help of Norman Paluba of the New Haven Water Company. A copy of the visual inspection check list is contained in Appendix A of this report.

The following procedure was used:

1. Inspection of the upstream area of the dam for cracks, shifting of the rock or evidences of erosion.
2. Visual survey of the crest and face for cracks and seepage at construction and expansion joints.
3. Check for seepage at interface between the rock and the concrete of the dam.
4. Measurement of the temperature of the seepage water, water in the reservoir and water downstream.
5. Check of the structural condition of the intake well and the bridge leading to it.
6. Observation of the downstream channel for boulders, branches, loose rocks and overhanging trees.
7. Photographs were taken of the general view of the dam and its appurtenant structures, (Appendix C, Plate 3) as well as other items that were given attention during the inspection.

Before the inspection, the design and construction plans were studied. A compact sketch of the dam and its surrounding area was made for use during the period of inspection (Appendix B, Plate 1).

In general, the condition of the dam and its appurtenant structures is good.

b. Dam - The crest and the downstream face of the spillway showed no visible cracks. A small amount of seepage was observed at two places on the downstream face (Appendix C, Photos 1, 7 and 8) as well as a steady flow from the interface of the dam and the ledge (Appendix C, Photo 6). The general condition of the body of the dam was good. On the apron at the toe of the dam is a metering weir with a gauge so that minimum flows can be controlled by means of the valves in the intake well.

c. Appurtenant Structures - The intake well has a valve operator for a 36 inch blowoff which can control the level of the reserovir. The valves were underwater but appeared to be in good condition and functioning properly. The visible concrete of the intake well appeared to be in good condition with no evidences of any significant cracks or spalling. The bridge out to the intake well had areas (Appendix C, Photo 3) that were spalled and weathered but in general was in good condition. There were no evidences that the intake well or the bridge and its abutment had experienced any settlement.

d. Reservoir Area - An inspection of the immediate upstream area showed no evidence of any movement of the adjacent embankment. A high water mark approximately 18 inches above the crest of the spillway was observed on the west abutment. The training wall that is on the east side of the dam is a gravity section and is in good condition with no signs of movement, cracking or spalling.

e. Downstream Channel - The dam was cut into rock at the same site that a natural waterfall had once been. The channel itself is in a fairly natural state with many large boulders and trees. Immediately downstream (400' ±) is a large concrete arch bridge (Appendix C, Photo 5). The waterway opening is very large and appears to be adequate hydraulically.

3.2 Evaluation

The visual inspection revealed no apparent areas of distress in the concrete. The observations did show some seepage between the rock-concrete interface and the construction joints, however, this is not detrimental to the safety of the dam. Overall, the general condition of the dam is good.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The responsibility of maintenance is with the New Haven Water Company. There are approximately 2-3 men that work at the site, although they may receive or give assistance to other dams in the area as required.

The access to the intake well and its attached equipment has been protected from vandals by the use of gates and chains (Appendix C, Photo 3). The purpose of the valve to the blowoff line is so the minimum flow downstream can be maintained. There is no written or formal operating procedure to control the reservoir for purposes of flood control. The water level is quite often several feet below the spillway crest, because of the demand to supplement water at Lake Gaillard.

4.2 Maintenance of Dam

The dam was designed so that its maintenance would be minimal. Since the completion of construction in 1956 the only maintenance regularly performed is to keep the access way to the site clear.

4.3 Maintenance of Operating Facilities

Except for paint, the operating equipment is as installed during the original construction. The valve operators on top of the intake well are chained in one position so that vandals cannot open or close the sluice gate.

4.4 Description of Warning System

There is no warning system in effect.

4.5 Evaluation

In view of the simplicity of the operation, the maintenance of the dam and its operating equipment seems adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - The 163 foot spillway and the 36 inch diameter blowoff are the only means of transmitting water past the dam. Under conditions of the Probable Maximum Flood (PMF), the spillway will carry a major portion of the flow.

Using the guide curves supplied by the Corps of Engineers (rolling), the PMF inflow is 28,275 cfs and the routed outflow is 18,975 cfs. The pond elevation at the PMF is 279.15 or 1.15 feet over the top of the dam. The spillway design flood is 14,285 cfs or 75.8 percent of the PMF.

b. Experience Data - The Hammonasset Reservoir Dam was built after all the major floods of this century and, therefore, did not experience any of them. A high water mark on the spillway abutment indicates a maximum high water of approximately 18 inches over the spillway or 1,000 cfs.

c. Visual Observations - The spillway channel which is a natural channel is in good condition.

d. Overtopping Potential - Calculations by Storch Engineers indicate that the PMF will overtop the dam by 1.15 feet.

SECTION - 6 STRUCTURAL STABILITY

6.1 Evaluation and Structural Stability

a. Visual Observations - There are no routine inspections conducted by the resident staff, however, maintenance workers at the dam site operate the sluice gates on the intake well simultaneously with the monitoring of the spillway and the downstream area.

The inspection did not reveal any significant damage to the dam and appurtenant structures, nor did it reveal unusual phenomena in the immediate dam area. It is concluded that the dam appears structurally stable.

b. Design and Construction Data - The design and construction data available were the original construction drawings, hydrological data and oral information.

The structural stability analysis of Malcolm Pirnie Engineers assumed the following:

1. Maximum flood line elevation - 277.0 feet;
2. Ice thrust from a two foot thickness of ice;
3. Uplift pressure at the base of the dam that varies from 3/4 of full reservoir pressure to zero at the tail water side of the dam;
4. Coefficient of sliding friction factor between concrete and rock equal to 0.7;
5. Unit weight of concrete equal to 150 pounds per cubic foot.

Design computations indicated adequate structural stability for all combinations of these loads. These calculations were not available for review.

c. Operating Records - The water level in the reservoir is measured daily.

d. Post Construction Changes - The dam has not undergone any post construction changes since the completion of construction in 1956.

e. Seismic Stability - The dam is located in Seismic Zone No. 1 and in accordance with recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - After study of the available documents, the results of this inspection and meetings with resident staff persons, the conclusion is that the general condition of the Hammonasset Dam is good. There is no cause to doubt the structural stability and concrete durability of this dam, however, there are some recommendations that are listed in Section 7.2 that will improve its condition.

b. Adequacy of Information - The assessment of the condition of the dam can be based on the information available as well as the visual inspection.

c. Urgency - The owner shall implement the recommendations within two to three years after receipt of this Phase I Inspection Report.

d. Need for Addtional Investigation - Taking into account the results of this inspection, additional observations for this dam should be undertaken.

Primary attention should be given to determine the reason for seepage at the junction of the rock ledge with the west wing of the dam.

7.2 Recommendations

It is recommended that the following actions be undertaken by the owner:

1. Instrument observations should be implemented at the leaking construction and expansion joints on the downstream face of the dam and at the junction of the rock ledge with its west wing. Seepage should be checked in dry weather after the apron of the spillway has been drained.
2. The following meterings and observations should be made:
   (a.) Seepage discharges, monthly or quarterly, arrangements for measurement of seepage should be commenced;
   (b.) Seepage water temperature, simultaneously with the measurement of seepage discharges;
   (c.) Chemical analyses of the reservoir and seepage water, simultaneously with measurement of seepage discharges, yearly. The water should be checked for pH, hardness, Ca, Mg, CO_3, HCO_3, Na+K, and CO_2;
   (d.) Sketches and photographs of the damaged surfaces of the crest, upstream and downstream slopes of the spillway, dike and abutments and the exterior faces of the service bridge, yearly.
3. Develop a systematic inspection program during periods of the highest and lowest reservoir levels.

A dry spillway apron should be achieved for this inspection to assure that all features of the dam are evaluated.

7.3 Remedial Measures

It is considered important that the following items be attended to as early as practical.

a. Alternatives - Not applicable.

b. O & M Maintenance and Procedures -

1. Grass, brush and trees on the downstream area around the dam for a distance of 30 feet from its toe should be removed to facilitate the visual observation and evaluation of existing and potential seepage.

2. The downstream spillway channel should be cleaned of loose materials, stones, brush and trees.

3. Surface deteriorations of concrete on the service bridge, west abutment and crest of the spillway should be repaired.

APPENDIX A

VISUAL INSPECTION CHECK LIST A-1 to A-8

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Hammonasset Reservoir Dam

DATE 8-1-78

TIME

WEATHER Sunny

W.S. ELEV. 262.3 U.S. 221.7 DN.S.

PARTY:

1. Richard Lyon
2. Miron Petrovsky
3. J. Schearer
4.
5.
6.
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Temperature of Air 65° F

Temperature of Water 73° F (upstream)

Temperature of Water 66° F (downstream)

PERIODIC INSPECTION CHECK LIST

PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME G. Giroux

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	Good
Current Pool Elevation	Good
Maximum Impoundment to Date	Good
Surface Cracks	None observed
Pavement Condition	N/A
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Not permitted
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	N/A
Piping or Boils	N/A
Foundation Drainage Features	Concrete gravity wall on rock
Toe Drains	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE _____ NAME M. Petrovsky

DISCIPLINE _____ NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	Underwater
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME M. Petrovsky

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	None observed
Visible Reinforcing	None observed
Rusting or Staining of Concrete	None observed
Any Seepage or Efflorescence	None observed
Joint Alignment	None observed
Unusual Seepage or Leaks in Gate Chamber	None observed
Cracks	None observed
Rusting or Corrosion of Steel	None observed
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	N/A
Service Gates	Gate valve underwater
Emergency Gates	Gate valve underwater
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System in Gate Chamber	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	Encased in body of dam
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE _____ NAME G. Giroux

DISCIPLINE _____ NAME M. Petrovsky

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	None
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	None
Condition at Joints	Good
Drain holes	None
Channel	Discharge into spillway channel
Loose Rock or Trees Overhanging Channel	N/A
Condition of Discharge Channel	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE NAME R. Lyon

DISCIPLINE NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	Underwater
Floor of Approach Channel	
b. Weir and Training Walls	Good
General Condition of Concrete	
Rust or Staining	Some due to iron content in water
Spalling	None
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Some at construction and expansion joint as well as rock interface
Drain Holes	None
c. Discharge Channel	
General Condition	Fair to good
Loose Rock Overhanging Channel	Natural boulder in channel
Trees Overhanging Channel	Several
Floor of Channel	Rocky, with several large boulders
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

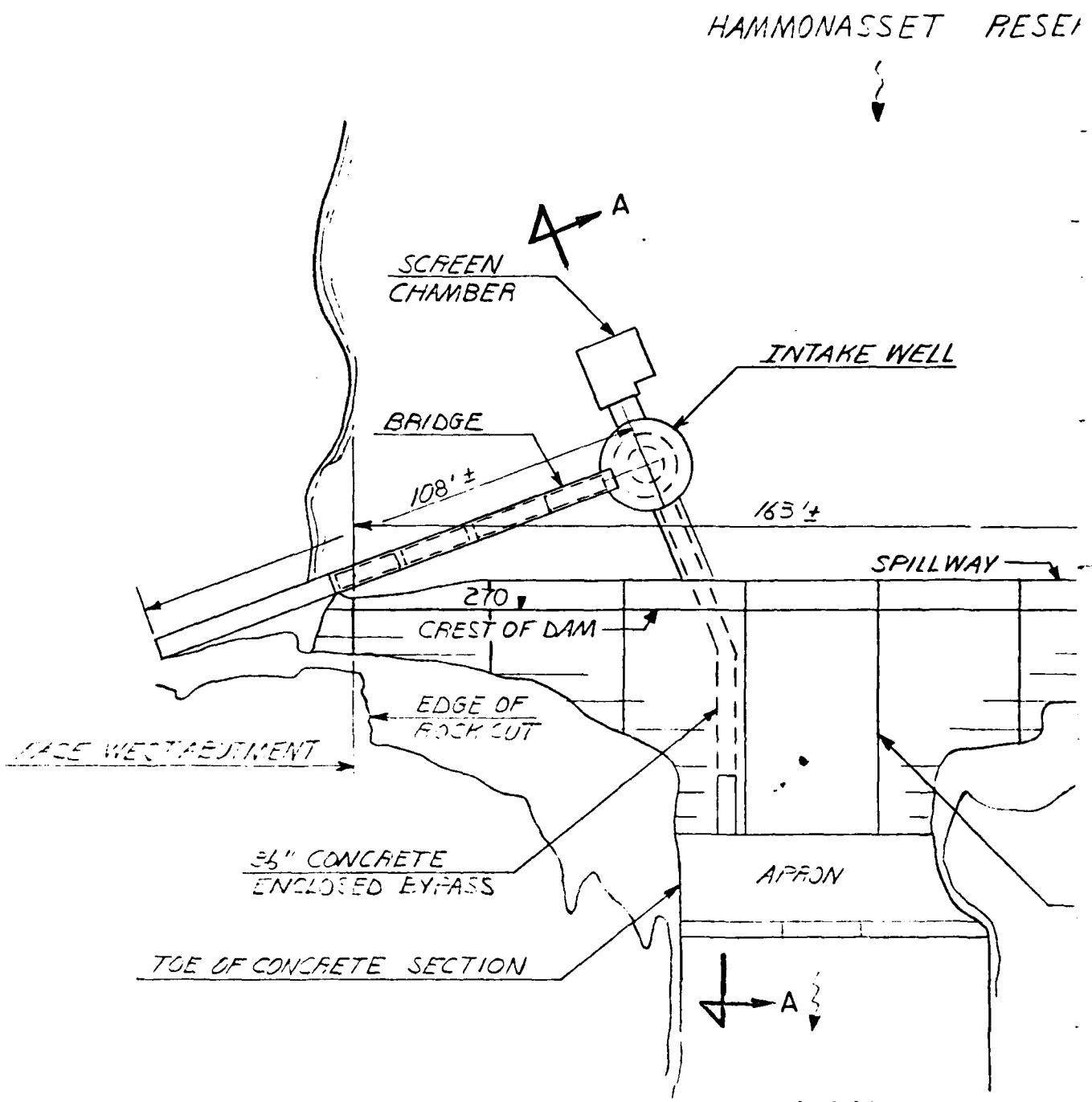
PROJECT Hammonasset Reservoir Dam DATE 8-1-78

PROJECT FEATURE _____ NAME J. Schearer

DISCIPLINE _____ NAME M. Petrovsky

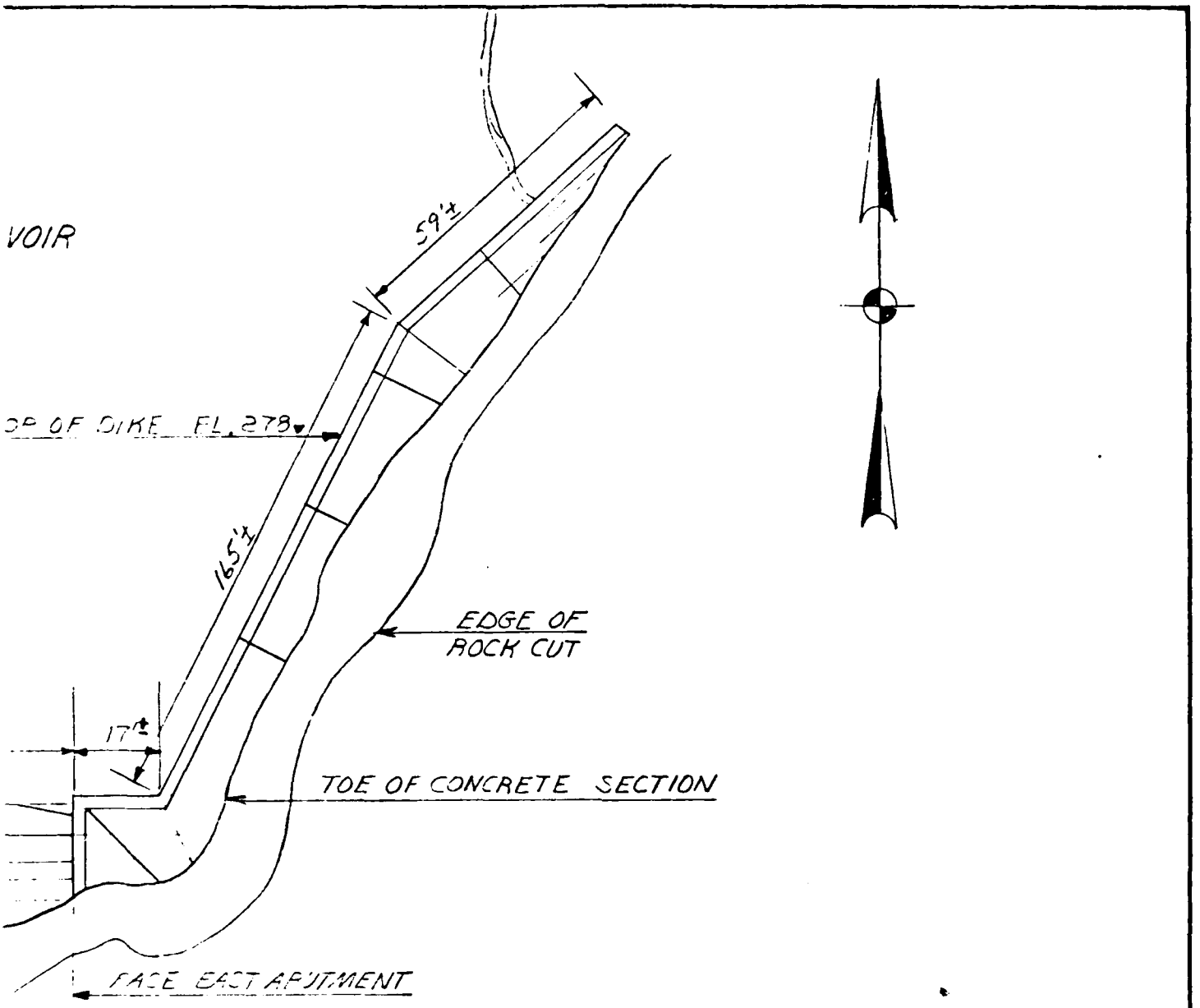
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure to intake	
Bearings	Good
Anchor Bolts	None
Bridge Seat	Good
Longitudinal Members	Some spalling
Under Side of Deck	Some spalling
Secondary Bracing	Good
Deck	Some spalling
Drainage System	None
Railings	Some corrosion
Expansion Joints	Some damage
Paint	None
b. Abutment & Piers	
General Condition of Concrete	Good
Alignment of Abutment	Good
Approach to Bridge	Good
Condition of Seat & Backwall	Some damage in bridge seat area

APPENDIX B



PLAN

NOT TO SCALE



CONSTRUCTION JOINTS (TYP)

NOTE

INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY NEW HAVEN WATER CO.

PLATE- 1

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

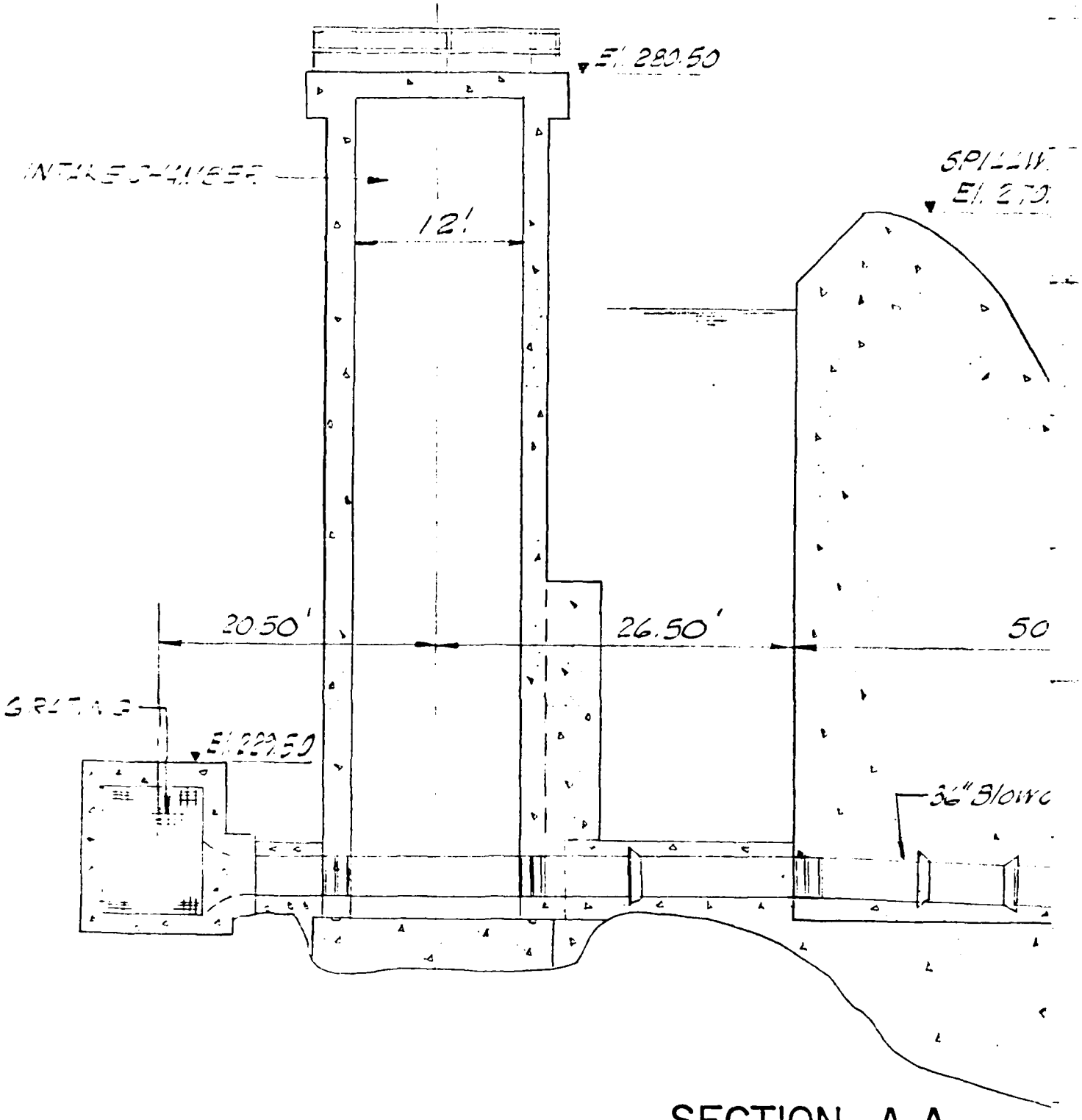
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

HAMMONASSET RESERVOIR DAM

HAMMONASSET RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : AUGUST 1978



SECTION A-A

SCALE: 1" = 10'

NOTE:
ELEVATION TAKEN FROM DRAWINGS
SUPPLIED BY NEW HAVEN WATER COMPANY

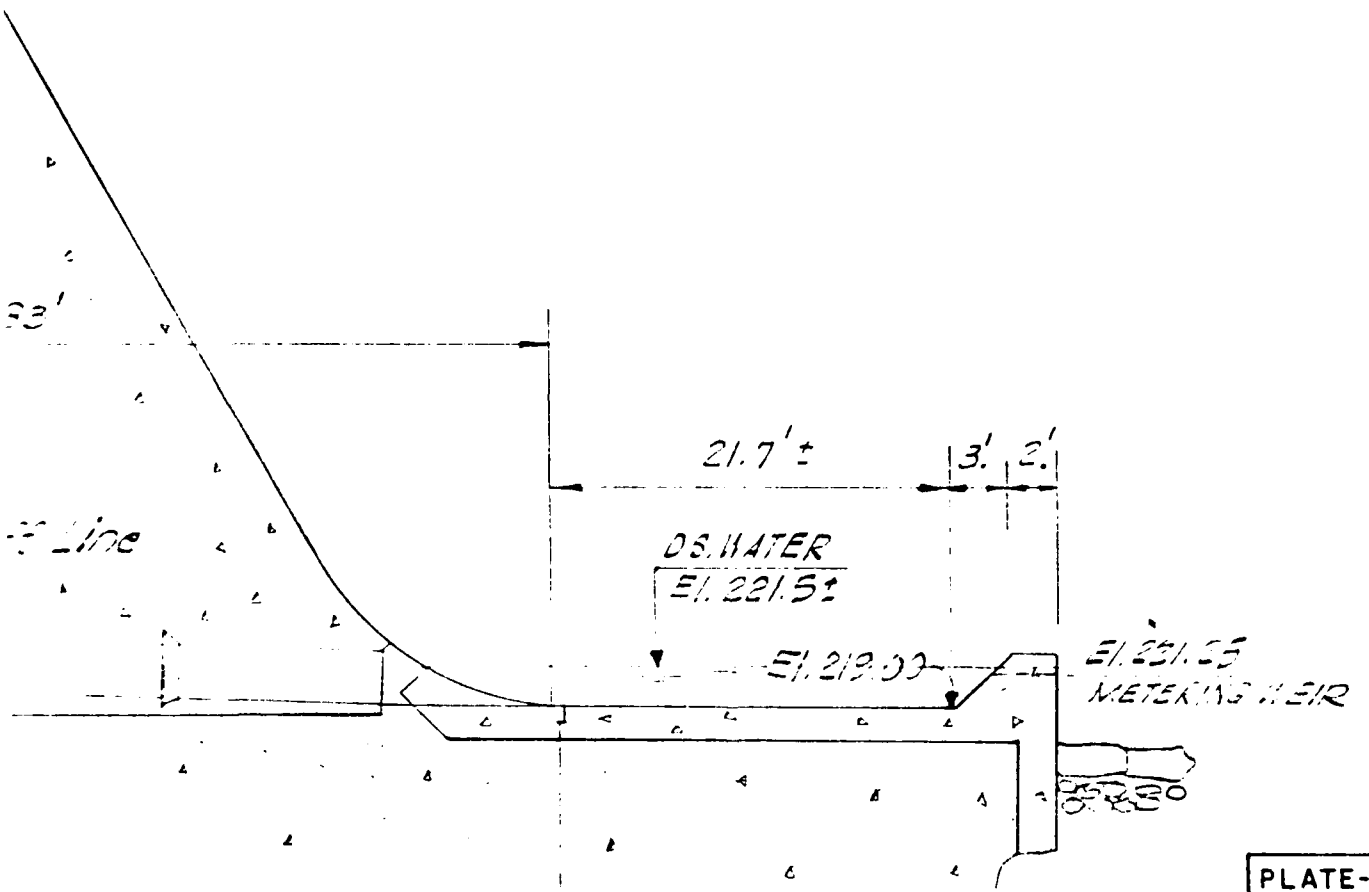


PLATE-2

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

HAMMONASSET RESERVOIR DAM

HAMMONASSET RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : AUGUST 1978

LIST OF REFERENCES

1. Drawings of Hammonasset Dam: (1) Location Plan; (2) Plan of Dam and Details; (3) Dam and Intake Chamber; (4) Dam profile and Sections; (5) Plan of Dike and Details; (7) Typical Sections; (8) Situation Plan and Access Road Location; New Haven Water Company; New Haven, Connecticut; March, 1957.

2. Recommended Guidelines for Safety Inspection of Dams; Department of the Army; Office of the Chief of Engineers; Washington, D.C.; November, 1976.

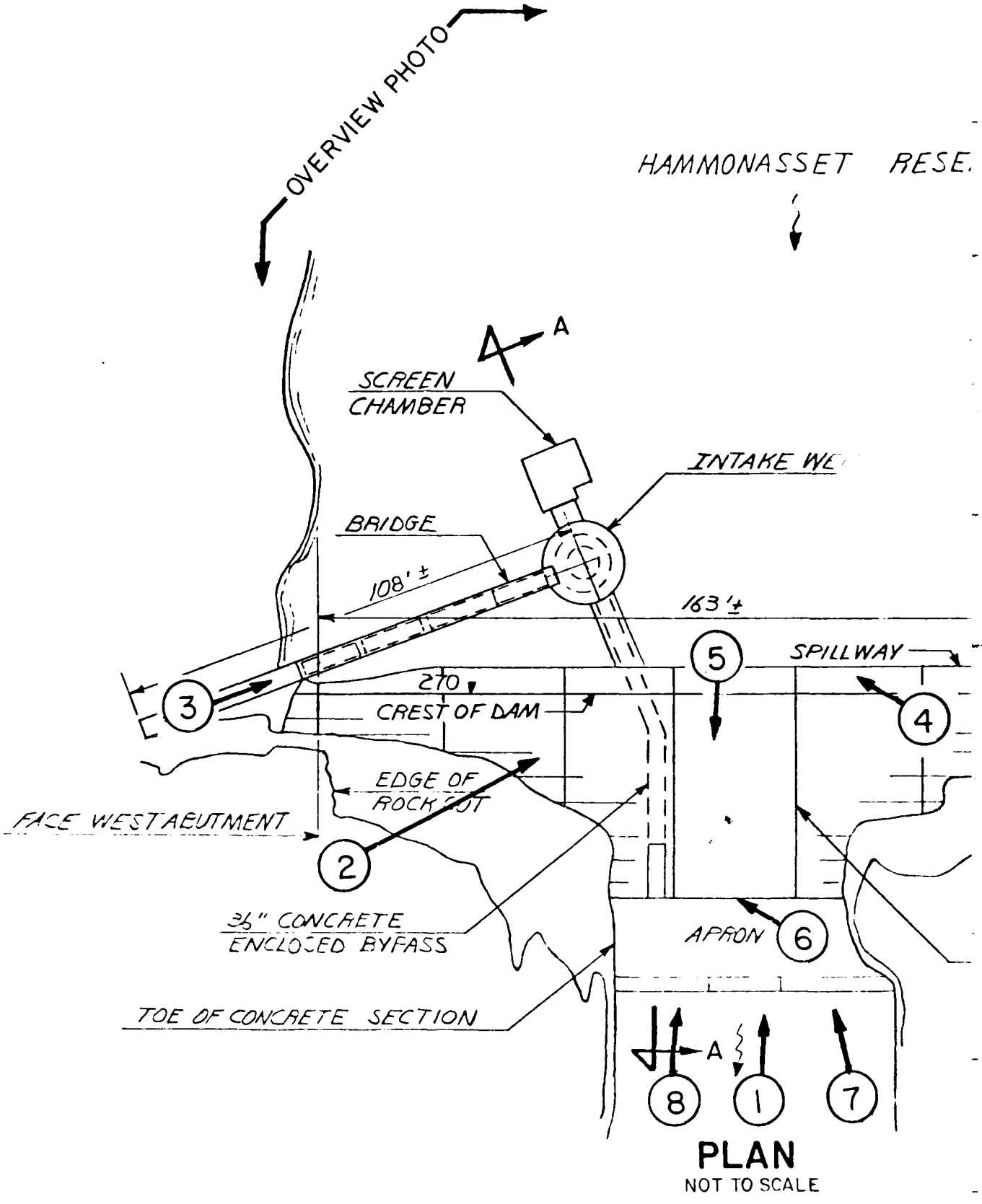
3. "Guide Curves for the Probable Maximum Flood (PMF) for Regions of New England Based on Corps of Engineers' studies; March, 1978.

4. "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations"; New England Division; Corps of Engineers; March, 1978.

5. Rule of Thumb. Guidance for Estimting Downstream Dam Failure Hydrographs; Corps of Engineers; April, 1978.

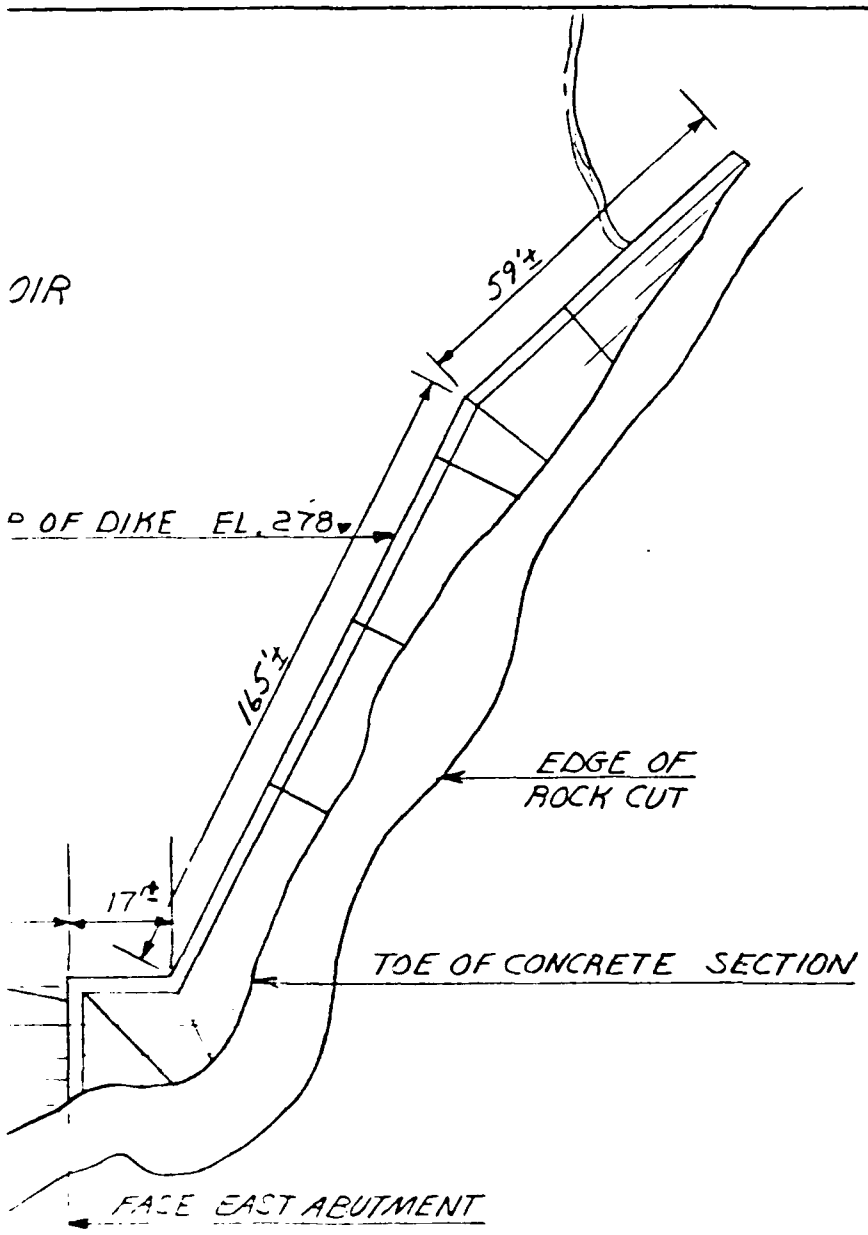
6. Capactiy of Hammonasset Reservoir above minimum effective level; New Haven Water Company; New Haven, Connecticut; June 17, 1957.

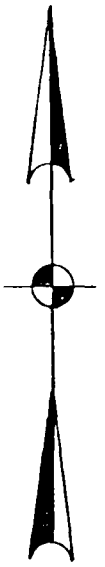
APPENDIX C



PLAN

NOT TO SCALE





CONSTRUCTION JOINTS (TYP)

NOTE:
INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY NEW HAVEN WATER CO.

PLATE-3

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

HAMMONASSET RESERVOIR DAM

HAMMONASSET RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : AUGUST 1978

PHOTO 1
DOWNSTREAM FACE OF DAM

PHOTO 2
CREST OF DAM

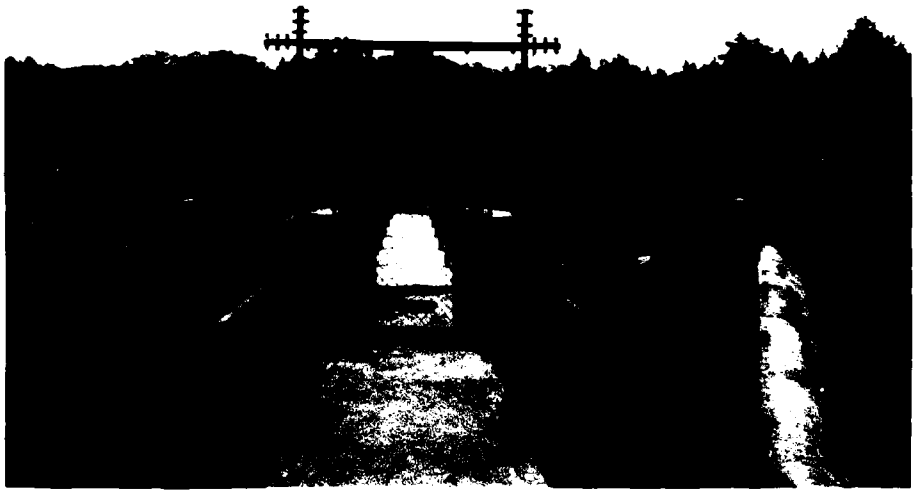


PHOTO 3

WALKWAY OF BRIDGE TO INTAKE WELL

PHOTO 4

CREST OF DAM LOOKING AT INTAKE WELL

PHOTO 5

LOOKING DOWNSTREAM FROM CREST OF DAM

PHOTO 6

SEEPAGE AT JUNCTION OF ROCK AND DAM

PHOTO 7

SEEPAGE AT FACE OF DAM

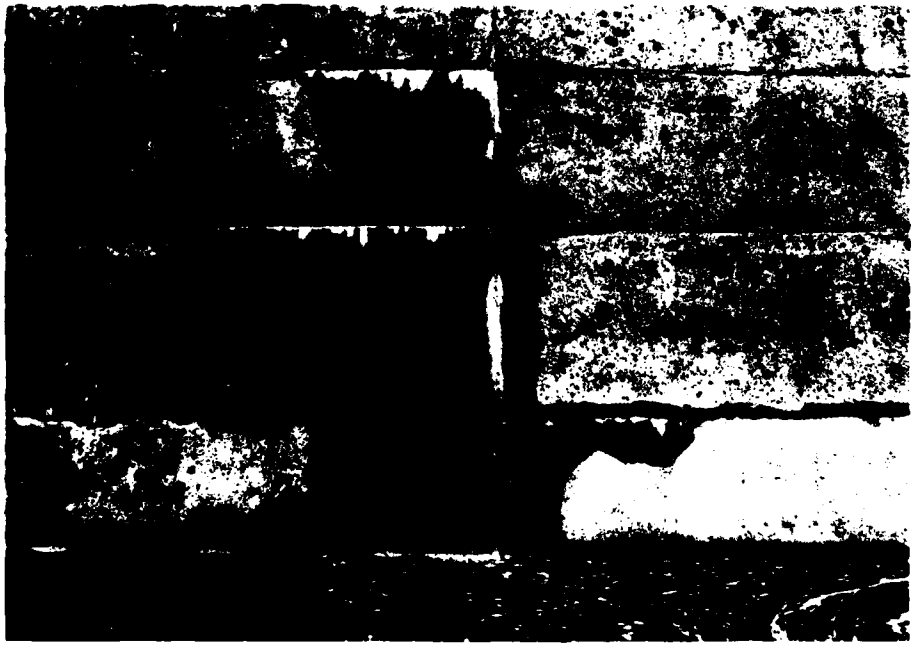


PHOTO 8

SEEPAGE AT FACE OF DAM

APPENDIX D

STORCH ENGINEERS
Engineers · Landscape Architects
Planners · Environmental Consultants

HAMMONASSET RESERVOIR DAM
STAGE DISCHARGE

SEE PLATES & FOR PLAN & ELEVATION

$$Q = C L H^{3/2}$$

	SPILLWAY				DAM				
ELEV	H	C	L	Q	H	C	L	Q	Q_T
270	0	0	163	0					
271	1	3.28		535					535
272	2	3.35		1,545					1,545
273	3	3.47		2940					2940
274	4	3.55		4,525					4,525
275	5	3.67		6,690					6,690
276	6	3.74		8,960					8,960
277	7	3.82		11,530					11,530
278	8	3.9		14,385	0	0	284	0	14,395
279	9	3.98		17,515	1	2.66		755	18,270
280	10	4.10		21,135	2	2.85		2290	23,425

STORCH ENGINEERS
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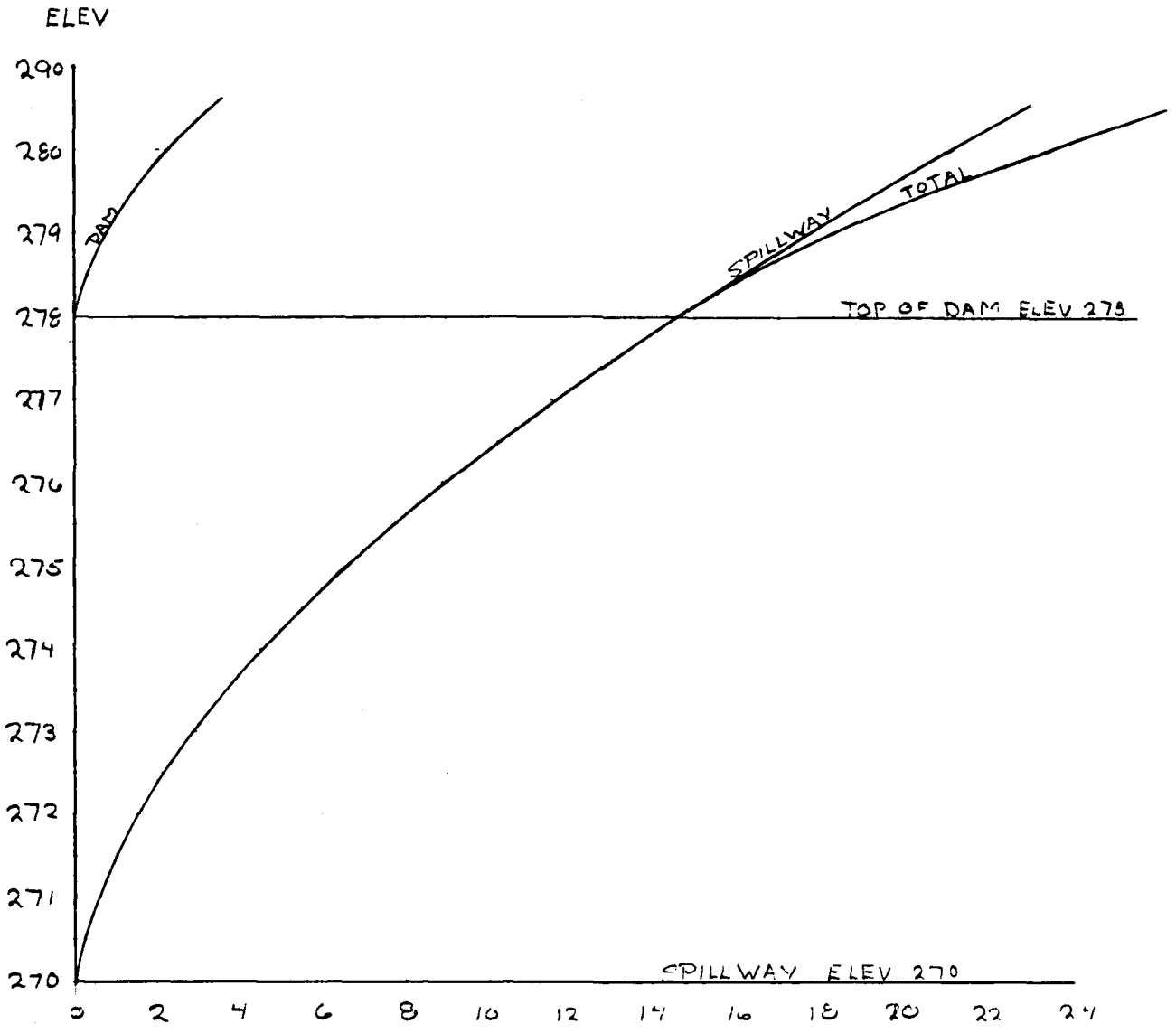
Planners - Environmental Consultants

HAMMONASSET RESETRVOIR DAM
STAGE DISCHATRGE



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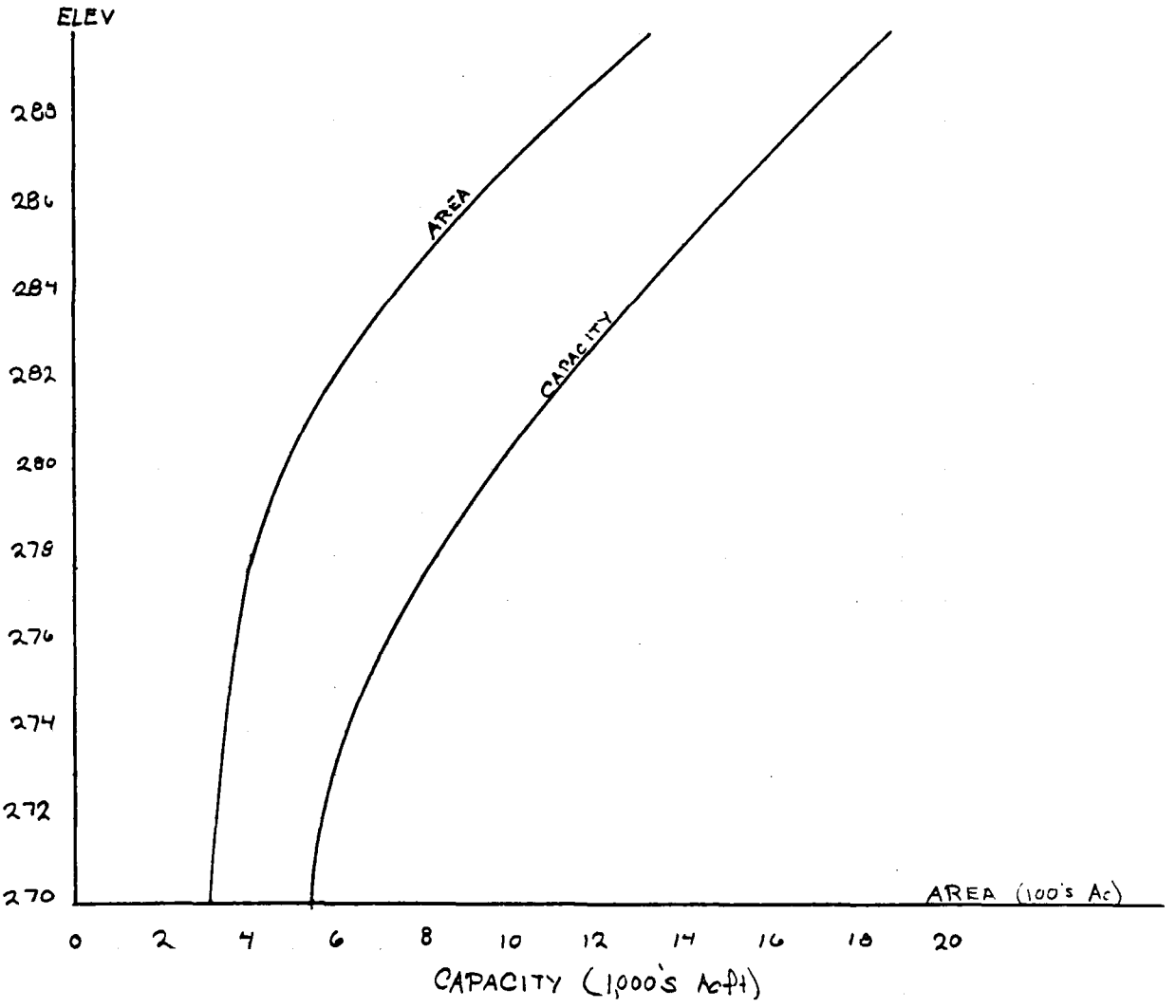
HAMMONASSET RESERVOIR DAM
AREA-CAPACITY CURVE

ELEV	DEPTH	AREA	AVG. AREA	VOL	Σ VOL. (ACFT)
270	-	310	-	-	5450
	8		360	2880	
278		410			8330
	12		865	10,380	
290		1320			18,710



HAMMONASSET RESERVOIR DAM
DETERMINATION OF SDF & PMF

DRAINAGE AREA - 19.5 SM

INFLOW (Ref. 4) - 1450 cfs/SM

PMF = 1450(19.6) = 28275 cfs

Determine the effect of surcharge storage on Maximum Probable Discharge.

① Q_{P1} = 28275 cfs
②a. H_1 = 287 (ELEV)
b. $STOR_1$ = 9.95"
c. $Q_{P2} = Q_{P1}(1 - STOR/19) = 28275(1 - 9.95/19) = 13,468$ cfs
③a. H_2 = 277.7 (ELEV)
$STOR_2$ = 2.55"
b. $STOR_A$ = 6.25"
$Q_{P3} = 28275(1 - 6.25/19) = 18,975$ cfs
H_3 = 279.15'

PMF = 18,975 cfs

Capacity of Spillway when the pond elevation is @ the top of the dam.

Q= 14,385 cfs or 75.8 % of the PMF

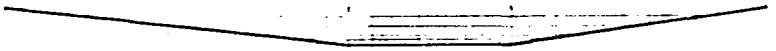
HAMMONASSET RESERVOIR DAM
SECTION NO 1

$n = .035$ $S = .9\%$

D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
5	140	400	2.85	2.0	.095	8.0	3,225
10	290	1300	4.48	2.72	.095	10.9	14,260
20	490	5200	10.6	4.83	.095	19.5	101,300
30	740	10800	14.6	5.98	.095	24.1	260,500

SECTION NO. 2

$n = .035$ $S = .05\%$



D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
5	490	1900	3.87	2.47	.022	2.31	4385
10	650	4800	7.38	3.79	.022	3.54	16,990
20	960	13000	13.7	5.73	.022	5.35	69,580
30	1350	22500	16.7	6.53	.022	6.1	137,240
40	1650	33000	23.0	8.1	.022	7.56	287502

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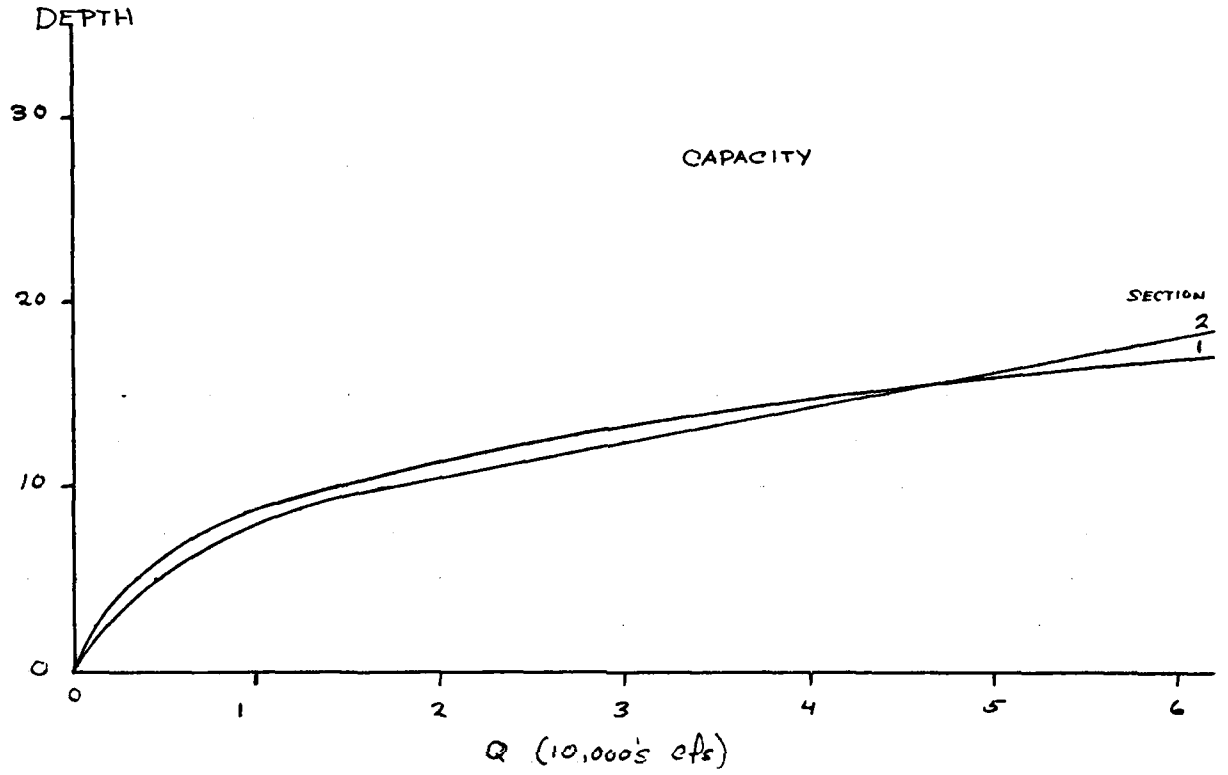
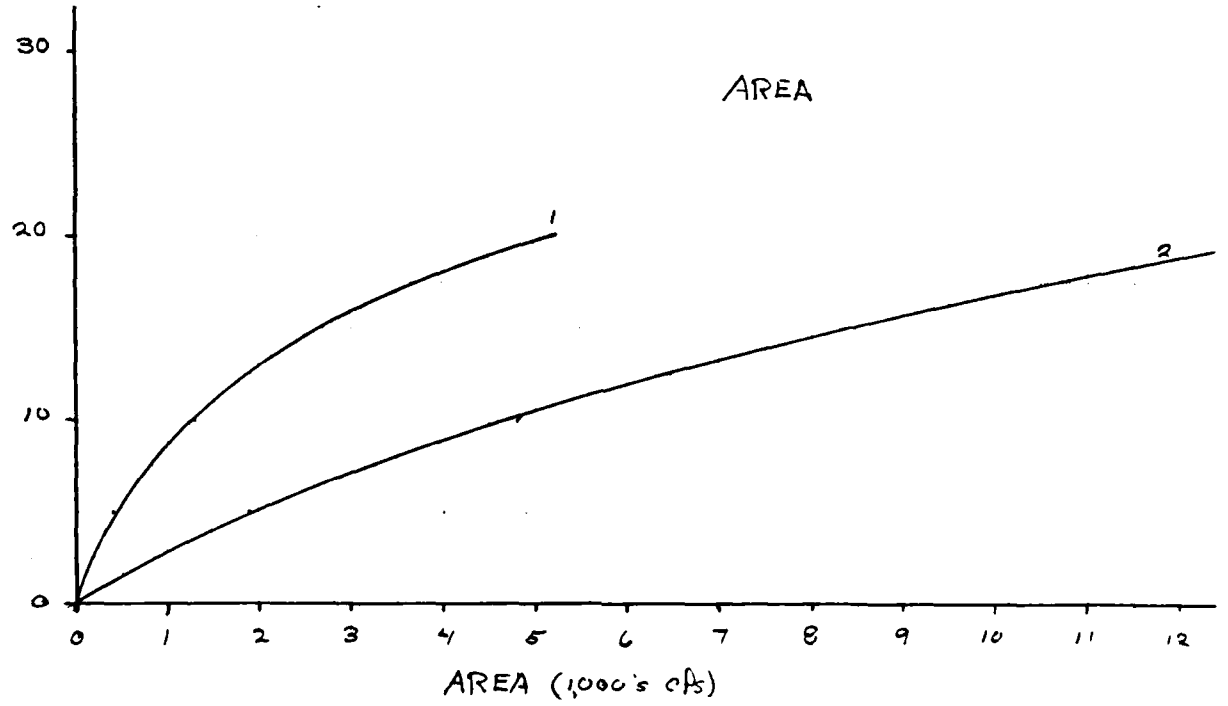
HAMMONASSET RESERVOIR DAM





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HAMMONASSET RESERVOIR DAM

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS

SECTION 1 @ Dam

① $S = 5450$ Ac ft

② $Q_{P1} = 8/27\, W_b \sqrt{g}\, y^{3/2} = 8/27\,(65)\sqrt{32.2}\,(20)^{3/2} = 38640$ cfs

SECTION 2 @ Chestnut Hill Rd.

③ See stage discharge Curve No 1

④ a. $H_1 = 14.5'$ $A_1 = 2600$ ft^2 $L_1 = 11{,}600'$ $V_1 = 692$ Ac ft

b. $Q_{P2} = 38600(1 - 692/5450) = 33{,}700$ cfs

c. $H_2 = 13.5'$ $A_2 = 2250$

$A_{avg} = 2425$ $V_{avg} = 645$ Ac ft.

d. $Q_{P2} = 38600(1 - 645/5450) = 34{,}030$ cfs

$H_2 = 13.7'$ $A_2 = 2300$ ft^2

SECTION 3 @ Madison, Clinton & Killingworth Town Lines Section 1

④ a. $H_2 = 13.7$ $A_2 = 2300$ ft^2 $L_2 = 14{,}800'$ $V_2 = 781$ Ac ft

b. $Q_{P2} = 34030\,(1 - 781/5450) = 29{,}150$ Ac ft

c. $H_3 = 13.0'$ $A_3 = 2050$ ft^2

$A_{avg} = 2175$ ft^2 $V_{avg} = 740$ Ac ft

d. $Q_{P3} = 34030(1 - 740/5450) = 29{,}410$ cfs

$H_3 = 13.1$ $A_3 = 2100$ ft^2

SECTION 4 @ Boston Post Rd Section 2

④ a. $H_3 = 13.1$ $A_3 = 2100$ ft^2 $L_3 = 18{,}000'$ $V_3 = 870$ Ac ft

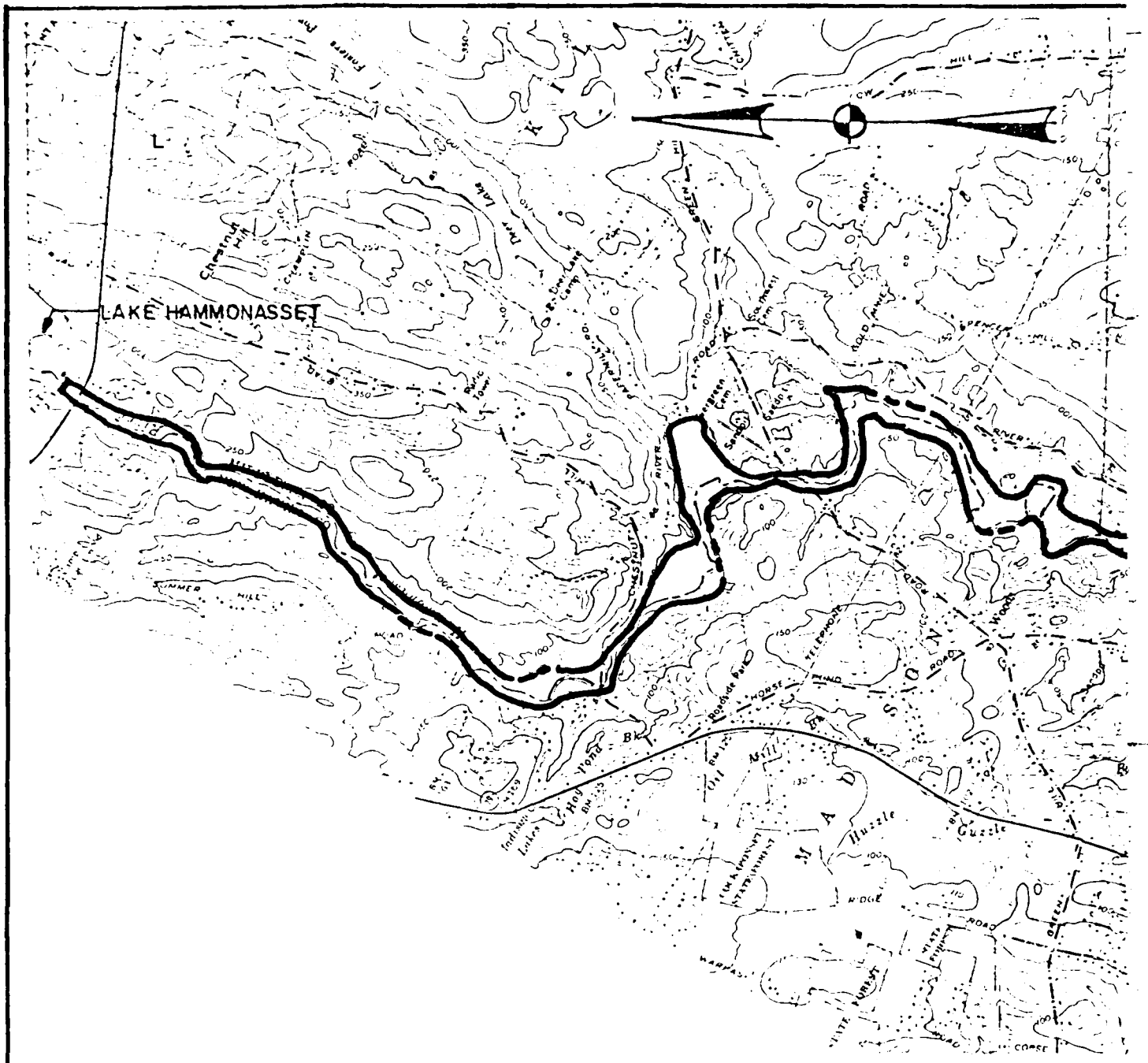
b. $Q_{P4} = 29410\,(1 - 874/5450) = 27{,}700$ cfs

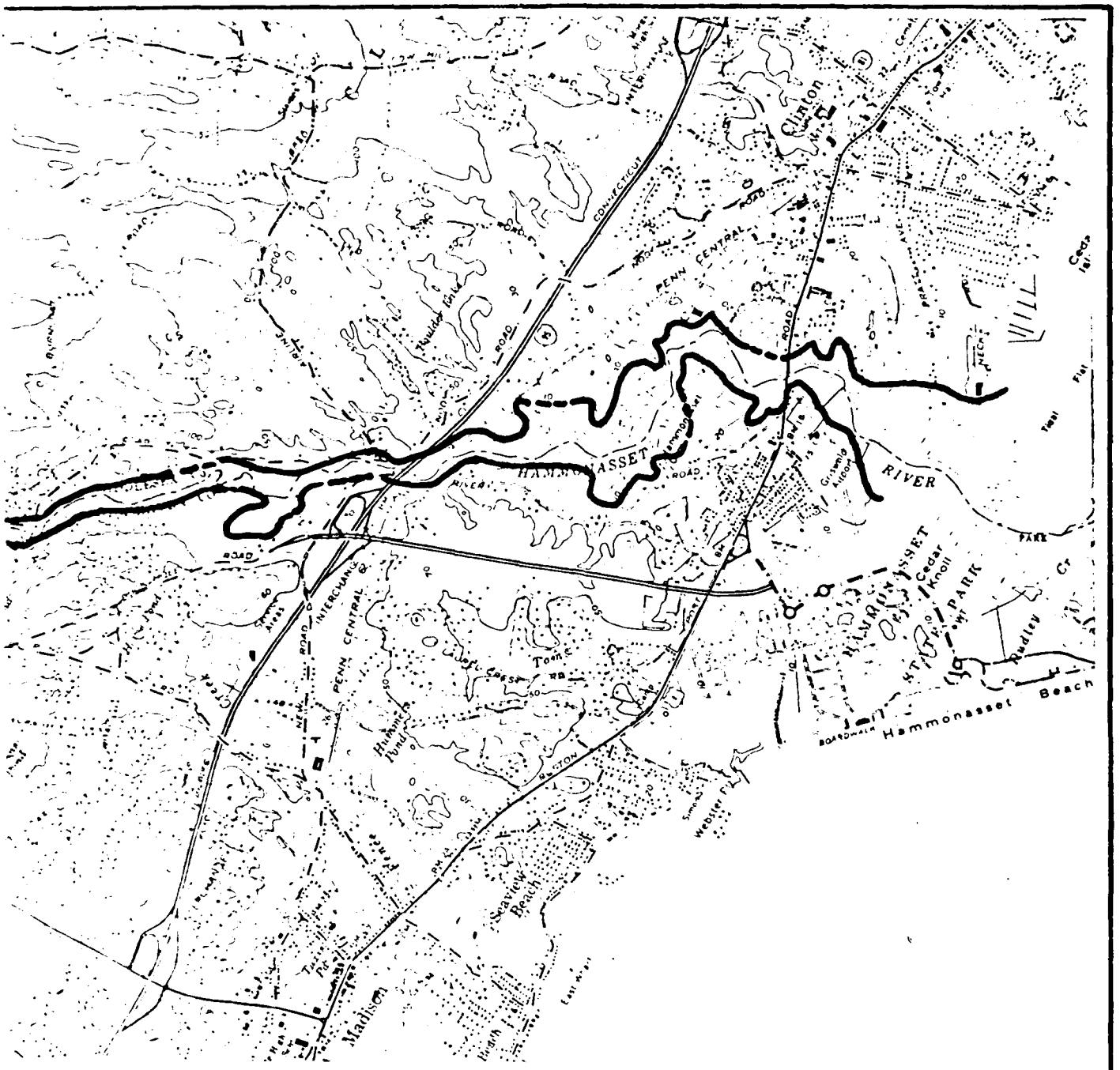
c. $H_4 = 11'$ $A_4 = 5500$

$A_{avg} = 3800$ ft^2 $V_{avg} = 1570$ Ac ft

d. $Q_{P4} = 29410\,(1 - 1570/5450) = 20{,}910$

$H_4 = 10.5'$


LAKE HAMMONASSET
REC
LEGEND
DENOTES LIMITS OF FLOODING
IN CASE OF DAM FAILURE
CONTOU



AL VICINITY MAP

PLATE-4

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

HAMMONASSET RESERVOIR DAM

HAMMONASSET RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : AUGUST 1978

.C

1 MILE

8000 4000 0 8000 FEET

1 KILOMETER

10 FEET

A LEVEL

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
CT	400	NED	CT	007	03				HAMMONASSET RESERVOIR DAM	4121.5	7236.8	08SEP78

POPULAR NAME	NAME OF IMPOUNDMENT
	HAMMONASSET RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	HAMMONASSET RIVER	CLINTON	8	5000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
CTPG	1956		50	45	8530	5450	NED	N	N	N	N	18AUG78

REMARKS

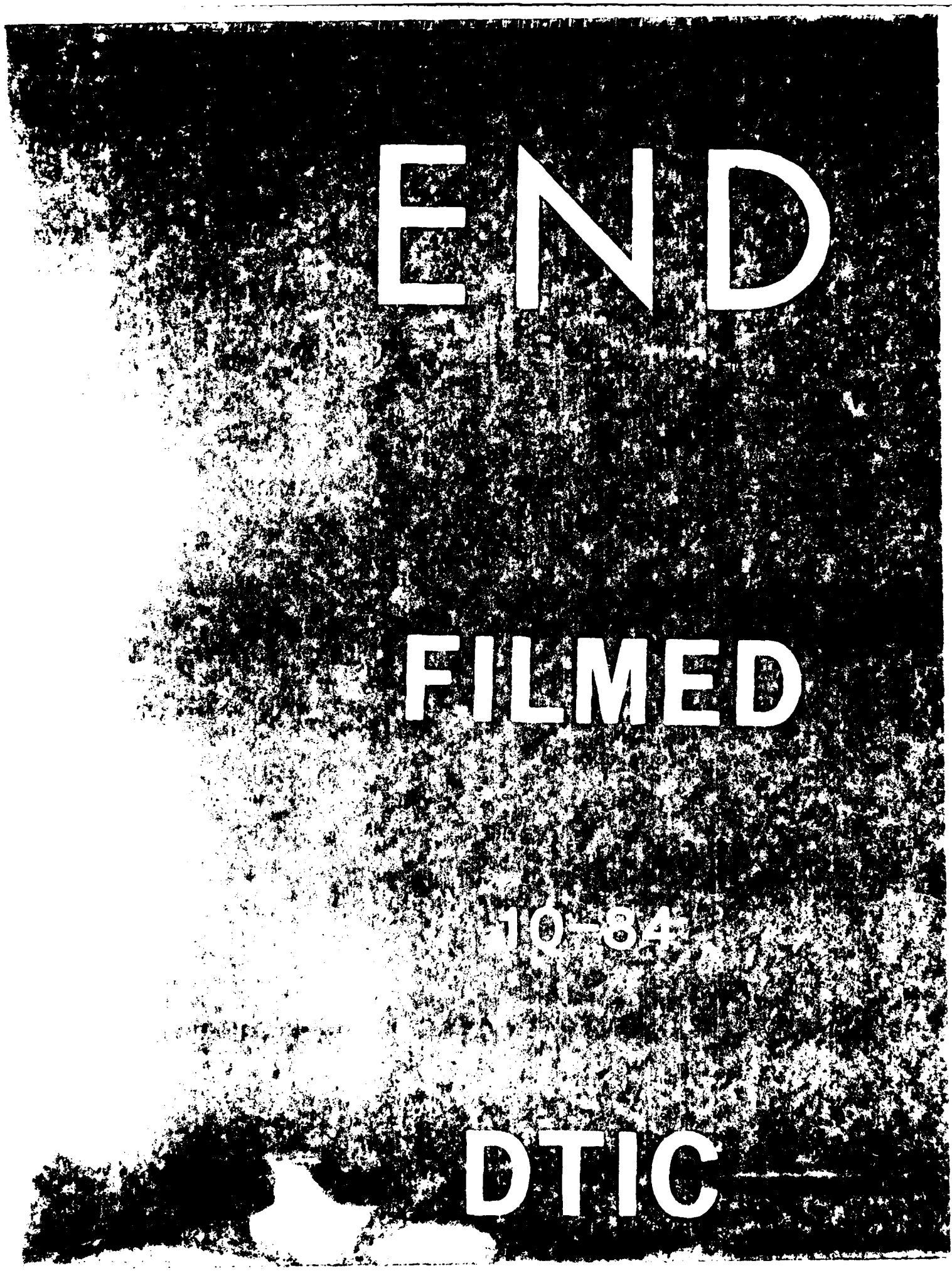
D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	180	U	163	14385	4500											

OWNER	ENGINEERING BY	CONSTRUCTION BY
NEW HAVEN WATER COMPANY	MALCOLM PIRNIE	

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
STORCH ENGINEERS	01AUG78	PL92-367

REMARKS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